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GEODE: Famous Masterpiece of Nature

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EARTH SCIENCE PRESENTS FOR FEBRUARY, 1961

"A geode is a hollow ball; at Oberstein, in Saxony, are found hollow balls of agate (chalcedony) lined with crystals of quartz or amethyst, which are termed geodes." Phillip's Mineralogy, 1828. This is the earliest definition we have yet found for one of Natures most intriguing artifacts: Cover Photo and other geode pictures used in this issue are by the courtesy of Geode Industries.

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Editor's Memo Pad

American Federation Beginnings*

By RICHARD M. PEARL

IT IS unlikely that the Chamber of Commerce of Ottumwa, Iowa knows that the American Federation of Mineralogical Societies had its beginning in that city. Dr. Ben Hur Wilson, of Joliet, Illinois, and I, however, have often reminded each other of this event, which took place in 1946 as the result of our correspondence on the subject of the formation of a national organization to unite the regional mineral federations and their thousands of members. Dr. Wilson was doing consulting work in the field, and my wife and I were on our way home to Denver by train after two years in Massachusetts. Ottumwa happened to be conveniently situated to the three of us.

As far as I am concerned, the first idea of such a national federation was given to me by Dr. H. C. Dake, editor of the "Mineralogist" magazine in Portland, Oregon. He remarked on the opportunity facing a nationwide federation to coordinate the activities of the regional groups, which existed mainly in the west.

The business meeting for the purpose of founding the new federation was held in 1947 in Salt Lake City, where the Rocky Mountain Federation was holding its convention. Dr. Wilson was elected the first president. As vice-president I was in charge of the first national convention, held in Denver in 1948.

Among the early programs was a contest to obtain an emblem, the design of which now appears on the official stationery. The "competing" design for an auto emblem was a later decision, in response to the need for a simpler design for this purpose.

*From a letter written by Pearl, in answer to an inquiry made by Russell H. Trapnell, Secretary, concerning the origin of the American Federation of Mineralogical Societies.

RIP RAP

In contrast to the strictly organizational jobs involved, brand new clubs have the ego-titillating task of selecting a name. Some of us are conservative and settle for something like The Maple City Mineral Club. Alliteration appeals to many: witness Lithic and Lapidary Society, Dry Dredgers, Boulder Busters, etc. The home of the Show-Me Rockhounds Association is (where else?) Independence, Missouri. Another club in Missouri leans to the lyrical—Heart of America. We noted a name the other day we like, The Good Earth Mineral Society, just getting off, or into, the ground in Columbus, Ohio.

We quote from the September 6, 1960 speech at Pocatello, Idaho of President-elect Kennedy: "The National Science Foundation Advisory Committee on Mineral Research has recommended intensive studies into new techniques of mineral discovery—to find new ways of locating and reaching the immense wealth which lies beneath a covering of sediments throughout the western states. Our methods of exploring mineral deposits on the surface, or near the surface, are no longer sufficient—particularly if we are to compete with foreign producers working in richer deposits of high grade ore."

While learning to probe more effectively for minerals beneath solid land sediments, the Institute of Marine Resources at the University of California suggests we look at a source of minerals covered only by water, but lots of water. On the floor of the Pacific Ocean lie nodules of 50% manganese content, in some areas about 3.7 lbs. of nodules per sq. ft. The nodules usually are about the size of and look like potatoes but one nodule recovered in 1955 weighed 1700 lbs. Significant quantities of cobalt, nickel and copper have also been found in these nodules. Cut in half and polished, they reveal a nucleus of clay-like material and well-marked growth rings around the nucleus.

GOETHITE—
Sub-species Limonite !

FOR more than a century limonite was considered an important and highly respected member of the great mineral family. Now — PRESTO! — and seemingly it has lost face in the mineral world. Its identity has been merged with its twin brother (or sister) goethite, and our good friend Richard Lake tells us the story as follows: "Dick", will you now please take over.

"Perhaps it is a sign of progress in the science of mineralogy when a once common mineral becomes non-existent. This is the story of one such mineral —limonite. We all know what limonite is—that soft yellow iron ore mineral that is often called "yellow ocher." Iron rust is the same thing. In the old textbooks its formula was given as $2Fe_2O_3 \bullet 3H_2O$.

"Most minerals can now be made artificially in chemistry labs. Around 1919 to 1935 various mineralogists noted that no compound with the limonite formula had been found in the artificial systems. At about the same time methods for identifying all minerals by X-rays were developed. A mineral would refract X-rays in such a way as to produce a series of markings on an X-ray plate, known as its molecular lattice pattern. Each mineral produces a different set of markings. Plates were made of our mineral —limonite. When checked against all other known iron minerals an identical plate was soon found. This plate was labeled—goethite. Further research showed that all limonite is actually cryptocrystalline goethite.

"The formula for goethite may be written $Fe_2O_3 \bullet H_2O$. When compared with the limonite formula above you will notice that limonite has more water (H_2O). Limonite was proven to be goethite, with absorbed or capillary water and perhaps a little clay. Pure goethite is usually found as reniform, botryoidal or stalactic masses with an internal fibrous structure. Because of its fibrous structure it is often called 'needle ironstone.'

"At the same time X-ray identification proved another iron mineral—turgite—was non-existent. It is a mechanical mixture of goethite and hematite.

"It is best to change the name of all your 'limonite' specimens to goethite. Perhaps you could add the descriptive term 'yellow ocher', 'bog iron ore' or 'brown ore' to distinguish it from fibrous goethite.

"The change of name is still in progress. Many of our largest museums have specimens labeled limonite. The name limonite is still used in many small fieldbooks. Some don't even list goethite. Many years will probably pass before the name limonite becomes as nonexistent as a mineral species."

Here, perhaps, is a real job for our various "Nomenclature Committees" to work on. What would they recommend that we do in this instance?

This is Worth Trying

Mr. Frank Smith, who resides at Posen, Michigan has collected stones on the Lake Huron beaches for more than 20 years. Some 10 years ago he took up lapidary work, and now sends us an innovation that he has discovered that perhaps is well worth trying.

He writes that after he has tumbled a batch for about two weeks, if he adds a very small quantity of fine saw-dust to the detergent, it removes more of the tin oxide from the stones, and does it quicker than any other method he has ever tried. "I would like to pass this information on to other friend 'Rockhounds' for whatever it may be worth," he says in closing his letter. He would welcome the correspondence of others upon the subject.

A Rare Privilege

It has been noted that the date 1961 can be turned bottoms up and still be the same. This is something that no person on earth will ever live through again because it will be 4,048 years before the situation recurs. The year will then be 6009.

So far there have been 20 years which read the same right side up and upside down. The latest was 1881.

James K. Luigs,
courtesy Chicago Tribune

Important Coming Events —1961—

FEDERATION SHOWS

June 9, 10, and 11. TEXAS FEDERATION OF MINERAL SOCIETIES. Annual Convention and Show. Armory, Wichita Falls, Texas. **North Texas Gem and Mineral Society,** host.

June 24, 25, and 26. CALIFORNIA FEDERATION OF MINERALOGICAL SOCIETIES. 22nd Annual Convention and Show, Los Angeles County Fairgrounds, Pomona, Calif. **Eight San Fernando Valley clubs, hosts.**

June 29 thru July 2. MIDWEST FEDERATION OF MINERALOGICAL AND GEOLOGICAL SOCIETIES. Convention and show. County Fair Grounds, Saginaw, Mich.

Aug. 10, 11, 12, 13. AMERICAN FEDERATION OF MINERALOGICAL SOCIETIES and **EASTERN FEDERATION OF MINERALOGICAL AND LAPIDARY SOCIETIES.** Combined Convention and Show, Municipal Auditorium, Miami, Fla. **Gemcrafters of Miami,** host.

Northwest Federation Of Mineralogical Societies

Aug. 31 thru Sept. 4. 21st Annual Gem and Mineral Show in conjunction with the Southeastern Washington Fair and Rodeo, Exposition Building, Walla Walla, Wash. **Horseheaven Gem and Mineral Societies,** hosts.

Mississippi Rock Fair

The Mississippi Gem and Mineral Society will hold its second annual gem and mineral show, the Rock Fair, February 18 and 19, 1961 in the main exhibit building, Mississippi State Fairgrounds, Jackson, Mississippi. Mrs. Ward Aspaas of Cornville, Arizona, with her Phonolite Rocks, will be a main feature of the show. Dealers write: W. B. Johnson, P. O. Box 4833, Fondren Station, Jackson, Miss.

Phoenix Gem Show

Phoenix Gem and Mineral Show will be held March 3, 4, and 5, 1961, at the State Fairgrounds, Phoenix, Arizona. The Show will be sponsored by Maricopa Lapidary Society and Mineralogical Society of Arizona. Milford Behnam of MSOA and Phoenix College, is general manager of the 1961 Show, the theme of which will be Birthstones.

The Show committee is negotiating for a special display of the replica of Aaron's Breastplate, owned by the Baptist Assembly, Green Lake, Wisconsin.

Plans for other special displays are being made; collections of newly discovered minerals, industrial diamonds from New York, polished material from Mexico never exhibited before, and fine carvings from California.

There will be numerous displays of birthstones cut and polished by members of Maricopa Lapidary Society together with other of their outstanding work; and rare collections of minerals with newest methods of mounting, displayed by members of MSOA.

Dealers from different parts of the country will have available all the newest and finest of mineral material from all over the world.

April 22 and 23. Wichita Gem and Mineral Society. 8th Annual Show. East Armory, 620 N. Edgemore, Wichita, Kans. 22nd, 12-10; 23rd, 10-8.

Our Authors

DORIS KEMP is active in promoting the work of the Midwest Federation, and at present is the Chairman of the Social Courtesies Committee. She has been cutting stones since 1956, making jewelry since 1957, and is now program chairman of the Chicago Lapidary Society, which holds its meetings regularly at the Ridge Park Field House, which is just east of Longwood Drive on 96th Street, Chicago.

Richard Tripp, who has done an outstanding bit of research on the "Mineral Inclusions of the Warsaw Formation Geodes" now has a book in preparation dealing with every known theory concerning their "formation/origin," including one of his own, which in view of his many years of study and investigation of this problem should carry much weight. Incidentally, Mr. Tripp is a nephew of our Dr. Wilbur Hoff, whose wife Donnafred is our art lapidary editor.

Both Dr. Fleener and Dr. Willems, both highly authoritative writers for our magazine, are too well known throughout the Rockhound fraternity to require further introduction; and to the others, also well known, we are grateful for their continued valuable contributions.

MIDWEST FEDERATION

GEMS AND MINERALS FAIR

AND 21ST ANNUAL CONVENTION

Saginaw County Fair Grounds, Saginaw, Michigan
June 29, 30, July 1, 2, 1961

The Tri-County Rocks and Minerals Society, Inc. of Saginaw, Bay, and Midland Counties, Michigan, extend a most hearty invitation to the 94 member clubs of the Midwest Federation of Mineralogical and Geological Societies to participate in the 1961 Gems and Minerals Fair. Fifty thousand square feet of floor space have been reserved for your use with an additional 8,000 square feet to be held in reserve. Five buildings for sure, and a sixth in reserve. Will we need this much space? Yes, if you, the member societies and the individual members of the Federation, support the Federation and your annual show.

This is your chance to show the Federation that yours is an active society. This is your chance to prove to yourselves that it's fun to belong, to make new friends, to meet old friends, to see the best of the Midwest collections on display. This is a chance for bulletin editors to get together, to sit down at the annual banquet to a wonderful meal, and top it off with a most distinguished and famous "Mid-Westerner" as guest speaker—the fabulous June Zeitner of Mission, South Dakota.

Send in your reservations as soon as possible to the following chairmen:

Society and Individual Exhibits
DONALD L. SOMMERFIELD
1423 North Carolina
Saginaw, Michigan

Commercial Space
DORIS L. SPRAGUE
11307 Swan Creek Road
Rt. 5, Saginaw, Mich.

Junior Exhibits
WILLIAM FORBES
403 Tittabawassee
Zilwaukee, Mich.

Judging and Awards
EVERET GAVER
523 N. Jackson St.
Bay City, Mich.

Editors Breakfast
ALICE KRAMER
303 Harrison St.
Midland, Mich.

Special Exhibits
HARRY H. SPRAGUE
11307 Swan Creek Road
Rt. 5, Saginaw, Mich.

Banquet
DORIS L. SPRAGUE
11307 Swan Creek Road
Rt. 5, Saginaw, Mich.

Registration
CORNELIA DEMERRITT
1913 Essex St.
Saginaw, Mich.

Hospitality
CECILE JOHNS
4484 King Road
Saginaw, Mich.

Publicity
DR. B. H. VAN HORNE
1314 Wallen St.
Midland, Mich.

Program
SCOTT WILSON
297 Donaghue Beach
Bay City, Mich.

Housing
ELLEN B. SMITH
1413 Sixth St.
Bay City, Mich.

All societies are being circularized with complete information. All other interested parties please contact the General Chairman, Harry H. Sprague, 11307 Swan Creek Road, Rt. 5, Saginaw, Mich.

Earth Science

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The Art of Fashioning Gemstones

by J. DANIEL WILLEMS

II. Ancient Gem Cutters, their Materials, Tools and Methods

THE CUTTERS

THE first cutters of gemstones were carvers. They were men gifted with skill and imagination, and a large supply of patience and persistence and resourcefulness. Their products were fashioned with admirable proficiency and have been preserved through the ages. Now they can be found in great plenty in many private collections and many museum collections, especially in Europe. The ancient stone engraver was without doubt a "professional", a man with a respected calling dedicated to his job of creating an object of beauty in an enduring form.

As in almost every art, ancient as well as modern, there were many individuals who took part in gem cutting. Even as today in the great amateur lapidary movement virtually uncounted numbers of persons are cutting gemstones, or have done so for a period of time and tired of it, so in ancient times vast numbers of gem carvers practiced their art. The large majority, however, have long since been forgotten. This is known from the fact that an artist's work will bear his own individualistic style of cutting, which can be recognized as surely as your own signature is recognized by the teller in your bank. Great gem carvers, as great painters, cannot disguise their characteristic marks. Contemporary writers tell of those carvers and their fame. But rarely are more than a few ancient gems encountered which are the product of the same cutter.

Among the many carvers in the distant past there were some who stood out as leaders in their profession. Around 400 B.C. some of these artists began to tell of their own fame by "signing" their works. Greek and Latin names are encountered, and experts can definitely trace them by the stylistic development through a series of cameos carved by them. An example is Pyrgoteles, the Greek, who was considered the chief artist in his day and was the only one allowed by Alexander the Great to engrave his image upon gems. This, however, did not stop usurpers from trying to imitate the master, and eventually hundreds of carved portraits of Alexander appeared which were detectable as frauds. Or, were they really frauds? Does it not take an artist to copy another artist?

There are in existence to this day lists of ancient lapidaries of several different countries and nationalities. In "A Catalogue of Engraved Gems" by Richter there is a list of names of prominent ancient carvers which is nine pages long. Back in those times certain relationships were recognized between gem carvers, sculptors, temple builders, and tomb designers, and all were held in equal esteem by their patrons. When we think today of the vast ruins of the art of Egypt, of Greece and Rome, of India, Burma and China it becomes clear that the number of artists engaged in the lapidary and allied activities must have been virtually legion. And these men "thought big" and produced big. Witness, for instance, the great Egyptian Sphinx, 189 feet long, a portrait of an Egyptian ruler carved out of one huge chunk of rock; and witness also the Colossus of Rhodes, a huge giant of a figure cast in solid bronze; and further, the virtually countless temples and tombs carved and erected everywhere in the ancient world. Alongside of these, at the other end of the scale, belong the artists who carved the ancient gems. The works of the stone carver with his hammer and chisel were fully equalled in imaginative conception and skillful execution by the carvers of the cameos and intaglios. They were truly great sculptures in miniature. In the noblest of temples and the most lavish of tombs these gems have taken their places alongside the greatest works of all time. The gem cutter ranked with the best. He created out of enduring materials by the skill of his hands and the versatility of his intellect abiding objects of beauty for the halls of fame, the scepters of kings, the breastplates of high priests, and the snowy bosoms of reigning Cleopatras.

Let it be said that in our modern-day efforts along similar lines we can point with pride to worthy examples, from the Mount Rushmore Memorial, the Christus atop Sugar Loaf Mountain in the harbor of Rio de Janiero, and the architectural splendors of our great art museums, bulging with the products of the art and the skill of the lapidary whose hands have coaxed from stone a bit of the essence of the Sun itself—to the beauty and magnificence of our lapidary exhibits in our annual gem shows. Such is our heritage!

THE MATERIALS

The ancient gem carvers used materials quite like that of our modern gem rough. Though these materials were the same, in many instances the names used are in confusion if not indeed in doubt. Even the names of the gemstones in the Bible are difficult to square with names used this day. The ancients did not have knowledge of the chemical or mineralogical composition of gem materials. They distinguished them mainly by their appearance, the heft in the hand, and by the colors. Almost every stone of a blue color was called sapphire, and any red stone was a ruby. This has been somewhat confusing to the student of the history of gems. It is, however, possible to examine hundreds of ancient cameos and intaglios and thereby establish what the trends and preferences were.

Although most of the ancient gems were cut primarily for the excellence of the finished cameo that could be fashioned from a certain piece of rough stone, they were almost never cut from finest gem material. Flaws and imperfections were taken for granted. Color was a primary consideration. The ordinary stones available in abundance today were also plentiful in ancient times and those the cutters used freely. The sources of supply and the cutting centers were often close, or at least within the same country. Artists that the cutters were, they each had their own favorites among the types of materials they preferred to work. They almost never cut two gems alike nor used the same material for all subjects. Each cameo they cut was an original though superficially portraits were very similar. It is safe to say that if two cameos are encountered that are alike in all details, one of them is the orginal and the other a copy, an imitation. In such a case the imitation is apt to be cut from finer material and the gem is apt to be slightly more perfect in workmanship. The imitator tried to outdo the originator.

Ancient cameos were made by preference of stones with two or more contrasting colors in layers. The banded onyx, or agate, lends itself well to this requirement. The banding results naturally in a dark background with a raised image in white. Nevertheless, a well-engraved gem on a clear or translucent orange or golden-tinted sard combines beauty of nature and beauty of art in an unrivaled manner. Such materials were highly popular with the ancient cutters.

Of all the materials used non-crystalline quartzes were by far most numerous. Carnelian of a reddish color was a favorite. Sard of a brown color was also popular, especially with certain artists. Chalcedony of pale smoky, milky white, yellowish and especially bluish gray was common. Plasma, especially of greenish color, was among the rarer roughs. It was often flawed with inclusions. Jasper of vivid color and opaque came in many varieties: black, red, green and yellow. When sprinkled with small red dots it was called heliotrope. Agate showing alternate layers in varying colors was a natural for the onyx or sardonyx type of cameos. In some regions a particular type of agate was called nicolo.

The most common crystalline quartzes used were rock crystal and amethyst. Amethyst material with unequal color distribution was sometimes made use of in a unique and pleasing design to make a more attractive gem.

Garnet was an important material, commonly found in the deep red color, but also in orange red and faintly violet hues.

Deep green emerald was extremely popular but rare. Its name was smaragdus—an elegant word—and it was frequently unengraved. Such a gem, simply shaped and polished, could possibly have been the forerunner of the modern cabochon. A story relating to those times is that the Emperor Nero was the possessor of a large, rounded, nearly transparent emerald which he held in front of his eyes when watching the gladiatorial contests in Rome. He claimed that the emerald not only made him see better but it also rested his eyes when they were tired. Versions and interpretations of this story are numerous. However it would imply that the gem was cut with smooth polished sides, and that it was slightly concave on the surfaces. It had accidentally been made into a magnifying lens for the nearsighted Nero.

Other gem materials used occasionally were aquamarine, turquoise, moonstone, peridot, lapis lazuli, true sapphire, malachite, and jacinth, which is red zircon. This was rare but highly esteemed by discriminating cutters.

Inferior materials were not infrequently used for carving. Among these were magnetite, hematite, steatite, granite, obsidian, amber, and glass.

Fig. 1. Ancient Gem Cutter.

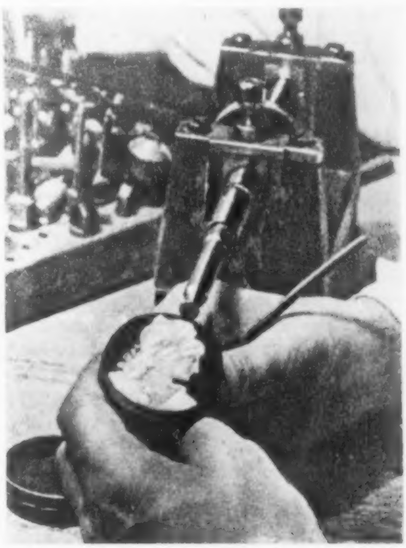


Fig. 2. Modern Cameo Cutter.

Stray examples of shale have been found, but such were exceptions and in a class by themselves.

Thus the list of carving materials used by the ancient carvers sounds quite like the modern list, except that shell, which is today the most popular, was absent.

THE METHODS

The ancient gem cutter engraved his gems mainly in two different ways: as cameos or as intaglios. Most of the carvers preferred one of these methods to the other, but there were some artists who had the talent to employ both methods. Cameo cutting, or engraving a gem in relief upon a convex background, requires working with tools which are adapted to work convex surfaces upon which the design "rises" as the work proceeds and the gem takes shape. Intaglio cutting on the other hand deals with concave surfaces, and the image produced is not in relief but is carved downward into the background surface. It is therefore the counterpart of cameo engraving, or a cameo in reverse, and concave surfaces exclusively are sunk into the background of the design.

To the early ancient cutter who used hand tools exclusively the features of these positive and negative procedures posed the problem of deciding between the two methods. It would be easier to cut intaglios than cameos. This is a likely reason why many more intaglios were actually cut, than cameos. It was easier to assure success.

Tools for cutting flat surfaces have convex cutting edges, concave edges being unpractical. A convex cutting edge scoring the surface of a flat stone will make a concave groove. It is therefore more natural to cut an intaglio than a cameo. But the same convex tool must also be used to cut the convex design on a cameo. This requires considerable skill over intaglio cutting.

Another situation arises when stones are selected for cutting cameos which are onyxes, those consisting of two or more layers of different colors forming sharp contrasts. The beauty

Fig. 3. Egyptian Stone Cutter.

of such cameos is greatly enhanced by sharp, clean lines of separation between the color layers. The white design resting upon the black background must therefore be slightly undercut, the black extending under or behind the sharp edge of the white in order to render the white figure in clean and sharp relief. This achieves the most pleasing effect. To engrave such an image with an outward-sloping base, with the white of the image graduating through gray into the black of the background will show the edges of the design ragged and fading, leaving an unpleasing effect. A careful scrutiny with a magnifying lens of a fine stone cameo, especially around the edges of the image and behind it will show many marks of the cutting tool that indicate the difficulty and delicacy with which such a procedure is carried out. It requires an artist of great skill to make the image come forward, jump out of the background, so to speak, and give the work a life-like, tridimensional depth. Such effect is not possible in intaglio carving.

The actual cutting of a stone into a cameo requires preliminary considerations beyond those we give to our modern cabochons and facets. It is important that the artist have first a good conception of what the capabilities of his stone are to receive an engraved design. Grain, color variations, lines and markings play a part and must be made the most of; not just any old figure goes on every old stone! The designer may have a fine piece of rough of very close grain, delightfully contrasting color layers, translucency, or even definite markings with meaning. Only an equally adequate design should be cut into such a fine rough to allow it to be cut so that it will bloom forth into an attractive cameo. And the other way around: A design of outstanding beauty conceived by a creative artist able to express his ideas in stone must be laid aside to await the proper stone to receive it. Scenes involving two or more heroic figures in violent action or combat require a large cutting surface, and carefully considered dimensions of balancing proportions. Length and breadth as well as the height and boldness of the image have much to do with the effect of the finished product on its viewer. Many of the fine ancient cameos are truly arresting in their effect.

Preparation in ancient times of the rough stone for engraving a cameo was a formidable undertaking. There were no diamond saws. The rough piece was likely to require many days of preliminary working to remove a large part of its bulk and reduce it to workable size and dimensions. This bulk had to be ground away to get to the "heart" of the matter, the usable part of the rock. Out of an irregular lump of rock a flat slab, carefully oriented and evened off, had to be produced. A figure accompanying this article represents an apprentice working such a stone into shape. After the slab was prepared the area of surface selected for the design was carefully measured and oriented. The design was then sketched upon the prepared surface of stone with sharp pointed tools. Some artists were not satisfied with this method, but prepared an exact model of their design in wax to accurate scale, which was then carefully copied step by step onto the stone. Cameos of perfect proportions, symmetry and balance and of a great degree of perfection were thus obtained.

Fig. 4. Ancient Cutter Working.

The earliest cutting tools were hand-held points of hard materials, usually corundum or garnet, but in many cases diamond slivers or points. Following the diamond point there came the drill, and later the wheel, or mandrel. These three basic tools have been enormously modified and refined, but still are the basic equipment of the cameo cutter today.

With these three tools the artists of old attained a remarkable level of perfection in their art. The single drill was soon augmented by multiple drill points, all manipulated by a single bow. The illustration of the Egyptian on these pages is one where three drill points are shown wearing away the excess on a gem held in a cupped wooden block, possibly cemented there. By such methods larger areas are blocked out roughly. This is shown in the illustration of an unfinished intaglio, which represents the crude beginnings of two seated figures with a standing figure between them. By removing further areas between drill holes with the diamond point the design was to be completed, but for some unknown reason was abandoned half finished. It was not unusual to start an engraving upon a gem and discontinue the work in various stages of completion.

For abrasions with the drill emery (corundum) powder was used with great effect. Another figure in this text shows a partially cut intaglio with the marks of two different kinds of drills, one a solid, the other a tubular drill, as seen in the illustration.

Plate I. Nos. 1, 2, 3, and 4. See title descriptions following this article.

Another illustration shows a finished gem, a portrait of a bearded Greek (probably Zeus) with the definite tool marks of a fine diamond point, working the hair and the beard. A very noble ancient gem this is, showing exquisite workmanship.

The Greeks of ancient times, as well as men of other nations, wore their beards full. With some exceptions the engraved gems show the male face bearded, at least in those gems that portray or imply full-grown courageous he-men, soldiers or combatants. This tendency gave way later to shaving the beard. In the time of Alexander the Great the beard began to disappear. Perhaps there was a practical angle to this. In those times hand-to-hand combat between men called for a strong right sword-arm, but a versatile left shield-arm. If an attacker could grasp his adversary by his beard and jerk him forward the sword would be rather remarkably effective. Too late to learn to shave! Perhaps shaving turned the tide of battle in favor of the shaven armies of Alexander who became quite a conqueror.

With the exception of the Egyptian bow drill there are few pictures or descriptions in the ancient literature regarding the tools used in ancient times. Experts in this field can, however, with microscopic search determine very accurately the methods by which the tools were used. Polishing the gems after cutting did not completely eliminate the marks made by the cutting tools.

The file was another tool which was used in a few cases, or perhaps, by only a few engravers. It was used for flattening and smoothing flat surfaces on softer stones. Emery was used with the file. The marks of the file are not easily identifiable. The only solid evidence of this method is the file held in the hand of a bronze statue of Theodorus, the noted gem engraver, as a symbol of his craft.

The wheel came into use probably soon after the drill. Like the drill, the wheel at first was powered by the bow. The wheel differs from the drill mainly in that it could be held rigidly in a mandrel, and the work could be brought to the wheel by the hand, while in the case of the drill the work was held rigid and the drill brought to it. Working with the wheel involved rotating and moving back and forth the gem, not the tool. The illustration of the mandrel and various wheels to go with it shows the type in style about 1750 A.D. It looks rather modern and even resembles slightly our latest Electric Sunbeam Drillmaster.

RECAPITULATION

For more than 5000 years dedicated individuals with creative artistic talent have carved gems, the so-called ancient gems. This endeavor has survived through the ages, through the rise and fall of civilizations, and is being practiced today with almost uninhibited zeal. Examples of the earliest gems are still preserved and cherished. Though methods and materials have altered, appreciation for the art has survived and goes on. Art is timeless.

Appended List of Descriptive Legends for pictures used in the above article, given in the order of their appearance

Fig. 1. Ancient Gem Cutter using foot-powered Spindle and Wheel in his well appointed Studio. One of the earliest pictures showing engravers at work. This method has been improved but is basically the same used today. (After Jost Ammon, 1568).

Fig. 2. Present-day Cameo Cutter working on an Onyx cameo. (From Idar-Oberstein: 2000 Jahre Edelsteinkultur).

Fig. 3. Egyptian Stone Engraver demonstrating the Process of Carving by means of multiple drills. With left hand he directs three drills simultaneously, each grinding a different area on the stone as he controls the drill shafts with fingers. The bowstring encircles each drill separately. With his foot he holds the cutting block steady. (From Scarabs by Newberry).

Fig. 4. Ancient Gem Cutter working on a rather large slab, probably wearing it down with an abrasive in preparation for the engraver for carving a cameo. Notice he uses no tools. (From Ars Memorativa, 1480).

Plate 1.

No. 1. An Unfinished Ancient Gem which shows clearly the use of two kinds of drills—the tubular drill which shows its marks on the eyes of the two lions and on the capital of the pillar, while the solid drill has been used in the rest of the work. (From Middleton, Engraved Gems).

No. 2. An Ancient Gem, well finished and showing the head of an ancient Greek (Zeus?). The use of the diamond point is here shown in the working of the beard and the hair, expertly finished. This noble cameo dates back to around 400 B.C. (From Middleton, Engraved Gems).

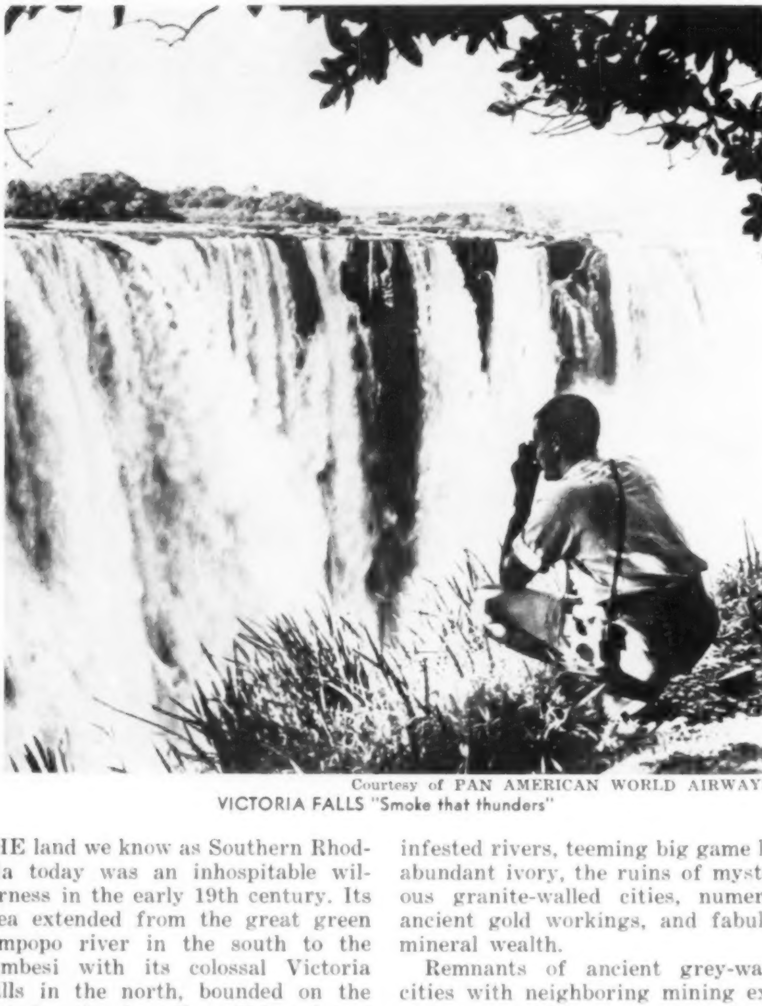
No. 3. An Unfinished Gem showing the characteristic marks of the wheel as well as the solid drill. This carving dates back to about 1400 B.C. (From Middleton, Engraved Gems).

No. 4. An Unfinished Ancient Gem. Three figures are roughly blocked out, one standing between two others which are seated. Many such roughed-out, uncompleted gems have been found. With a solid drill a series of blunt depressions have been made which are later worked into sculptured figures. (From Middleton, Engraved Gems).

Other articles upon this most interesting subject by Dr. Willems are to follow in future issues of Earth Science.

The Prospector In Southern Rhodesia

By T. H. L. FORD, ESQ.



Courtesy of PAN AMERICAN WORLD AIRWAYS
VICTORIA FALLS "Smoke that thunders"

THE land we know as Southern Rhodesia today was an inhospitable wilderness in the early 19th century. Its area extended from the great green Limpopo river in the south to the Zambesi with its colossal Victoria Falls in the north, bounded on the east by the brooding Chimanimani mountains with their rain-forested ravines, and on the west by the wastes of the Kalahari desert. Intrepid Boer hunters returned to South Africa from their forays to the north with tales of the "smoke that thunders", a mighty waterfall, great crocodile- and hippo-infested rivers, teeming big game life, abundant ivory, the ruins of mysterious granite-walled cities, numerous ancient gold workings, and fabulous mineral wealth.

Remnants of ancient grey-walled cities with neighboring mining excavations on gold, copper, and tin formations, found extensively throughout this portion of the African interior, left no doubt in the minds of these first white hunter-prospectors of the pre-existence of a powerful race of ancients, thoroughly versed in the prospecting and mining of metals. The origin of these ancients is still a matter of controversy, but it has been conceded that this could have been the land of Ophir of Biblical times, from which source the venturesome Phoenician Sabaean traders extracted vast quantities of gold and other minerals, some of which were used in the construction of King Solomon's temples. Calculated estimates of the gold won from these workings, and the indications of a fortified trade route to the coast greatly enhance this view.

The early gold prospectors had little difficulty in locating numerous payable gold reefs, as the ancients were unable to mine below water level with their primitive methods. Many rich Rhodesian gold mines operate to this day on these ancient sites, very few, comparatively speaking, being founded on virgin reefs.

Southern Rhodesia was populated in early times by peaceful Bantu tribes. In the early 1800's a breakaway portion of the bloodthirsty Zulu nation, styled the Matabele, invaded the country. This was the start of a reign of wholesale slaughter, rape, pillage, and arson. The more peaceful tribes were almost exterminated, the remnants forced into utter subjugation. Meanwhile, Cecil John Rhodes had begun the expansion of his financial empire from his holdings at Kimberley in South Africa. His agents succeeded in obtaining a mineral concession from the savage despot of the Matabele, Lo'Bengula, which permitted the entry of a white pioneer column into the subjugated territories to search for minerals. As the whites entered, using their rifles to bring down the plentiful game, the starving remnants of the conquered tribes flocked to them, offering their services in return for food. They were accepted as servants. But impis (regiments) of marauding Matabele warriors pursued single or small groups of prospectors, tortured and massacred the Bantu servants and stole their belongings. Vehement protests to Lo'-Bengula were of no avail. Eventually some 700 pioneer prospectors banded together to march 300 miles into the territory of the Matabele. There the outnumbered whites decisively defeated the Matabele and forced them into surrender.

When peace was finally restored in the last decade of the 19th century, the future appeared more stable. Unhampered prospectors combed the rugged territories for precious metals and stones. Along the contact zones of the granites and basement schists numerous gold mines sprang into production, a large number founded on the excavations of the ancients. The discovery of vast coal fields was the prelude to construction of a railway system, to take the place of the laborious ox-drawn transport. The enormous loss of life (a life per mile) from diseases, wild animals, and all kinds of perversity brought full realization to the pioneers of the enormity of their task.

Some 45% of Southern Rhodesia's land surface consists of granitic-type rocks. Lying ribbon-like and highly contorted within these granite batholiths are remnants of the oldest primitive rock systems, both sedimentary and of plutonic origin, which owe their highly mineralized state to the invading acid magmas. These crystalline schists of the Archaen Basement complex are referred to as "Gold Belts." Large remnants of later Cambrian and younger formations cover various parts of this country. Each gives rise to vegetation peculiar to that formation and with respect to its climatic aridity.

With access to the base metal markets of the world, a prospector of wider scope was born. Now situated at a reasonable distance from railhead, numerous high grade deposits of chromite, asbestos, tin, lithium, beryl, copper, nickel, iron, limestone, mica, corundum and other minerals were worked. Uneconomic diamond leads, with subordinate rubies, sapphires, zircons, garnets, aquamarines, etc. and latterly high-quality emeralds, also came within the range of mining potentials.

Mining operations here, as elsewhere, are based on extensive prospecting.

The modern prospector, in conjunction with a helpful Geological Survey Department, and with an elementary knowledge of geology and mineral recognition, traversing deep into rugged country now further afield from the rails, can still find deposits of fabulous extent. Although modern cities and well civilized tracts have been developed near the main transport systems, there remain large remote areas, scarcely ever seen, which demand uttermost respect from any venturesome body planning to investigate them. During the fever pitch of the uranium boom many city-born "prospectors", unwittingly following the click of the counter, became hopelessly lost in the dense bush. Luckily most were found by search parties, more dead than alive.

The immense variation in rock systems is a treasure house of unique mineral specimens to those who recognize their rarity. During the writer's many prospecting forays, good specimens receive as much respect as the economic deposits themselves. For example, a lengthy corundum bearing brilliant emerald-green fuchsite mica, carrying corundum crystals ranging from grey through violet to purple, is startlingly beautiful. So are portions of quartz geodes with their hollow interior a mass of perfect radiating amethyst crystals; lilac lepidolite greisen with rubellite tourmalines on one side and radiating pink to green toumalines on the other; brilliant black-flecked nephrite of the greenest hue; glittering black biotite schists with bright green beryl crystals; twinned garnet crystals as large as your fist; copper ore consisting of malachite, azurite, chrysocolla, tenorite with cerussite encrustations. These are the rewards to the assiduous searcher.

Although disappointments are many, and rewards are appreciated because of their scarcity, the lure of Southern Rhodesia to the prospector is unchanging. The open spaces are his, the woodsmoke campfire, stars flickering through the outstretched boughs of the grotesque baobab tree, the ever-present whine of the dreaded mosquito, the nearby yapping of jackals, interspersed with the cackling laugh of the hyenas and the faroff thunder of a lion, the myriad voices and unutterable beauty of the African night.

If you want to prospect, then this is the land.

Burned Opals Restored

Important Discovery Announced

OPALS have long been ranked among the most destructible of gemstones. It is well known that they do not tolerate dehydration or burning. Many fine opals have been destroyed in this way, causing great heartbreak, loss of assets, and fortune.

In the course of events in Hungary in the autumn of 1956 the National Museum of Budapest became a victim of fire and its world famous collection of opals (presumably precious Hungarian opals) was extensively damaged. Many of the stones were burned black, cracked, or completely shattered. Their fire and color play, as well as their graceful elegance and beauty, were totally lost.

All pieces not completely in ruins were carefully salvaged by Professor Dr. Hunek, the curator, in the hope of saving some of the better stones, principally those that were still more or less intact although colorless and blackened by fire. First, an investigation of all available literature on opals was undertaken. This gave little hope, so that clearly individually initiated procedures became necessary. Prof. Hunek established the fact that there was still retained within most of the burned stones a small quantity of water held in combination, after the fire. This water under ordinary conditions accounts usually for from 1% to 21% of the weight of the stone, but in precious opal more specifically from 6% to 10%. The curator then tried to establish the weights of the burned stones but was not able to come to very clear conclusions as to the amounts of water lacking in the burned stones.

(*Continued on Page 23*)

Solderless Jewelry Through V-Lock Mounting

By DORIS E. KEMP

Doris Kemp, showing three frames used in lecture describing V-mount.

THE V-Lock mounting method is simply a method of permanently fixing a length of wire to a polished stone. The idea originated with the late Gus Brown and other members of the Des Moines (Iowa) Lapidary Society. Gus showed me this simple solderless method and I have gone on from there, adding my own ideas and innovations which I would like to pass on to others who may be interested.

This method is particularly adaptable to modern design, also to the filigree type. Little equipment is necessary. There is no soldering, no drilling, and yet I believe this method can be used to greater advantage than the bell cap, peg and bail, drilling, or other method of mounting stones. A trim saw with a blade size about .025 in. thickness, several pairs of pliers, a pocket knife, several gauges of wire, and some polished, ready-to-use gem stones will be needed. The stones may be any size, any shape or thickness, cabs or flats, slabs or slices, but as completely polished as stones ready to set in commercially made mountings.

Before we go into the steps required to make the V-Lock, we must decide what article of jewelry we are going to make. Suppose we decide to make a pendant using a triangular-shaped stone. With this type of mounting there is no set rule as to which is the top or bottom or side of your stone except, perhaps, to let the pattern or design in the stone govern the lines of design. Lay the stone on a blank piece of paper, draw a pencil line around it. With the idea in mind that the finished stone can be suspended from any angle after the wire has been fixed to it, decide where you wish the fixing point to be. From this point sketch a design showing how you would like to arrange the wire around the stone. Let us decide to have the wire come from the bottom of this stone, just to be different, since most other methods have the stone suspended from the center top. Let us have the wire frame the stone, starting from the center bottom, bend up along edge of stone to the center top. At this point make a loop (this is where the neck chain will go through). Continue to extend the wire around the other side of the stone like a frame and bend around bottom to the center where the wire originally started. Make a curl of some type to give a graceful ending. As a further aid, take a piece of string and lay it on top of the penciled wire lines. Following these lines, mark the length when you come to the end of the curl of the wire, add ½" and cut the string at this point. This gives us an idea of how much wire we will need for this piece of jewelry. Now we are ready for Step 1.

Step 1

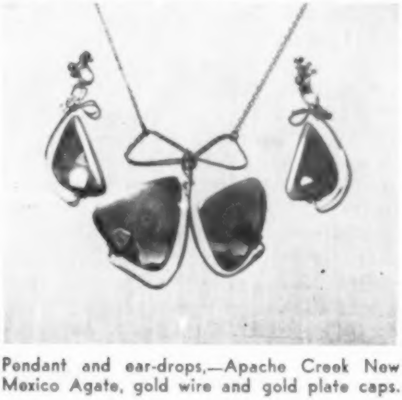
Cut into the stone at an angle, about ¼" deep. Fig. 1. Back cab away and turn the cab on the saw's table so that the saw will cut into the same cut only at the opposite angle. Fig. 2. Cut again about ¼" deep and then back the cab away from the blade. A third cut, running the blade into the same opening, directly in the center, takes away the jagged edges in the center of the V-cut. Your stone now looks like Fig. 3. This is where the "V" comes in; it is an inverted V. The opening is wider at the bottom of the cut and this is the trick which prevents the wire from slipping out; this is the "Lock."

The size V cut you make depends on what type of jewelry you are making, and what gauge wire you will use. I have found that for pendants the 16 gauge sterling silver round wire and 18 gauge gold-filled wire are quite satisfactory. For earrings or eardrops, weight is a great factor, so use 20 or 22 gauge wire. Stainless steel wire can be used but it is a bit more difficult because of the spring in the steel, and aluminum wire is quite soft and bends too easily. If you compare the cost of gold and silver wire to the cost of gold plate and rhodium plate commercial mountings, the wire proves to be cheaper and gives the finished piece richness and lasting beauty.

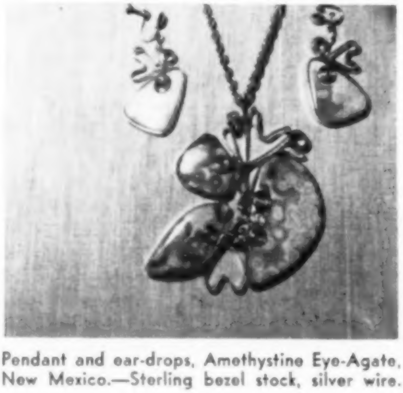
Step 2

Take the needed length of wire, which we had determined by the string measure, and, using a pair of nose pliers, twist a loop on one end of the wire. Fit this loop into the V cut so it will not pull out at the top of the cut. It will slide in and out sideways but, after mounting, the wire is so embedded that it will not come out. Fig. 4. Using strong wire, like piano wire, a very large slab can be mounted this way and suspended dangling from the wire for use in other innovations of the V-Lock method.

Several materials can be used for cementing. An acrylic resin cement which is used by dentists is the best so far. Many types of this are available. The best way to secure this cement is to ask your dentist or seek a



Pendant and ear-drops,—Apache Creek New Mexico Agate, gold wire and gold plate caps.



Pendant and ear-drops, Amethystine Eye-Agate, New Mexico.—Sterling bezel stock, silver wire.

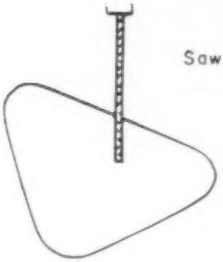


Fig. 1

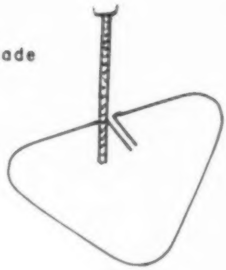


Fig. 2

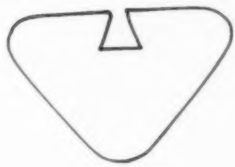


Fig. 3

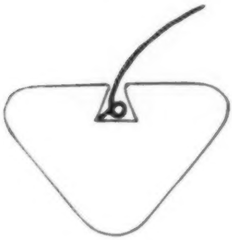


Fig. 4

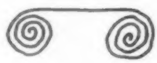


Fig. 5


Fig. 6

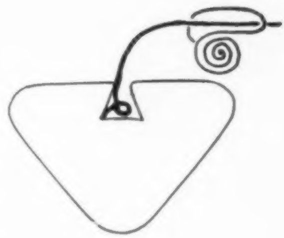


Fig. 7

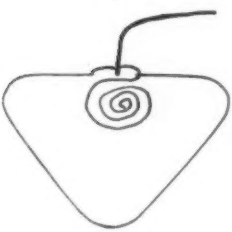


Fig. 8


Fig. 9

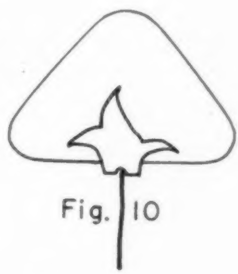


Fig. 10

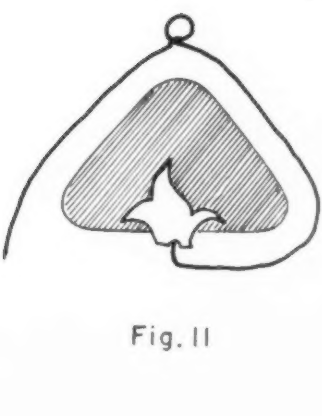


Fig. 11

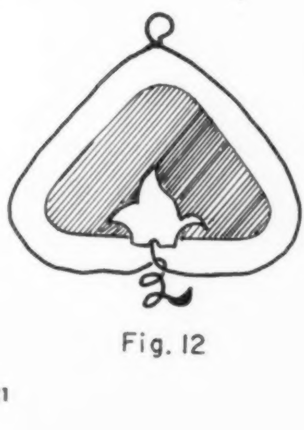


Fig. 12

dental supply company. Another material is liquid aluminum which comes in tubes and can be found in hardware stores. Presently new epoxy resins are being developed and one of these may be satisfactory also. The cement is put into the V-cut on both sides. Be sure the wire is extending from the center of the thickness of the cut. Scrape off the excess cement with knife edge or razor blade. Acrylic cement sets in 10 to 15 min. We can then proceed with the next step, which is capping or covering the V-cut. This step is not absolutely necessary; some prefer to leave the cut uncovered which is desirable when acrylic cements are used because they are transparent and blend with the stone's colors and so are invisible on some pieces. However, to my taste, putting a cap or covering on adds to the design and gives the piece a finished look. I have found several ways of making caps.

Step 3

The whorl or flat coil type cap is quite easy and very efficient, and also adds to design and strength. The whorl may be made with a small hand vise, or pliers, or with the finger tips. Using flat nose pliers seems to be easiest for me. See Fig. 5. The silver sheet cap is made from 26 or 28 gauge sterling silver sheet. Thin aluminum sheet could also be used, but this does not have the mirror finish that silver can be given.

To make the silver cap, decide on a design and draw the pattern on the silver sheet. A good hint regarding silver sheets is to glue a plain sheet of white paper to both sides of the sheet as soon as you have purchased it. Use rubber cement for gluing. This will keep the silver from being scratched any more than necessary. On this paper draw your design and, using a jeweler's saw, saw design out. Whatever your design may be, be sure you mark the very center, and through this mark drill a hole with a drill size to match the gauge wire you have used on your piece of jewelry. This hole permits your cap to slip on the wire extending from your stone, as a bead is threaded. Fig. 6. This silver cap must be put through the steps of buffing and polishing. First file the edges so no saw marks show. I suggest a fine steel wool for buffing and polishing, rubbing the surfaces briskly in one direction until a fine smooth satin finish is achieved. This could be the final finish if a satin finish is desired. Otherwise, work with a fine 320 grit emery cloth (a worn one is best), and rub briskly in one direction. Wash piece in mild soap and water. Next, a hand or motor-driven muslin buff is used with stick tripoli. Wash again. Final finish is with a muslin buff and jeweler's stick rouge. Electric buffs at high speed are best, but a nice finish can be obtained with the hand and elbow-grease method.

Now, with either the whorl or the cap ready to be put on the pendant, we need to do a bit of bending. The whorl is bent to fit on both sides of the stone and the cap is bent likewise. Slip the cap or whorl over or on the wire, and fit it tightly over the V-cut area. Then slip it back a bit and put a drop or two of a transparent jeweler's cement (usually a glyptal resin) over the V-cut, and slip the whorl or cap back in place. Figs. 7 and 8.

Step 4

Being sure the cap is secure, we now proceed to bend the extended length of wire around the stone to form the framing design. I use plain nose pliers, with the jaws covered with adhesive tape to avoid scratching the wire. Many bends can be made with the finger tips; this really avoids scratching. In our design we decided to have the cap at the bottom so let us hold it that way. Fig. 10. Our first bend is at the cap. Make the bend at a point in the wire about 1/8" from where it extends out of the stone. Bend wire around, following the contour of the stone, to the top center of the stone. Fig. 9. Try to keep the wire running parallel to the middle of the stone's edge. Make a loop in the wire at the top center of the stone; this is for the neck chain to slip through.

Fig. 11. Bend wire on around to bottom of pendant where wire extends out the 1/8". Bend wire around and through this 1/8" space and with the remaining end of wire, pound the end flat with a small hammer and make a curl by twisting the wire around the tapered jaw of the chain pliers. See Fig. 12. This finishes this piece of jewelry.

This type of design is just one of many. Other modifications of the principle of V-Lock mounting are the Hidden V-Lock cut; and the metal-to-stone, a wide cut used in lapidary sculpture and for mobiles and stabiles.

One hint in regard to sawing the V-cut. Do not cut the V-Lock on a point of a triangle. The reason is that a certain width of stone must be left on both sides of the cut to avoid cracking off of too-thin sides.

V-Lock mounting can utilize stones that otherwise might be useless for jewelry. If a fracture appeared during the final polishing, for example, a stone may still be used by making the V-cut at the fracture spot. We need not saw as deep as the fracture, just the usual 1/4". The cap may be made large enough, then, to cover the entire fracture.

We have all had the experience of a stone or slab cracking into two or more pieces. If a stone, finish off the rough broken edges, arrange in an artistic fashion or as the stone was originally shaped, make V-cuts, and join with wire. A broken slab can be polished on all sides and joined with V-Locks like a broken stone.

Any number of cuts can be made in a stone, provided there is enough area to accommodate the cuts. Small stones may then be arranged in clusters accompanying a main stone.

We all have hidden talent. All we need is to experiment a while and before we realize it we come up with some very interesting ideas and produce things which our friends will enjoy. Our life is enriched thereby and we all have fun in the process. Good luck!

Comment: We heard Mrs. Kemp present an excellent lecture on V-Lock at the October 21, 1960 meeting of the Lapidary Section of the Earth Science Club of Northern Illinois. She exhibited a beautiful array of V-Lock jewelry of her own design which was of professional quality in its workmanship. We highly recommend the V-Lock method to amateur and professional lapidaries. Specific inquiries in connection with your experiments with V-Lock may be addressed to Mrs. Kemp at 19 E. 144th Street, Chicago 27, Ill.

Donnafred Hoff, Art Lapidary Editor.

(Continued from Page 18)

The water content changed from weighing to weighing according to conditions. Acting without any scientific precedent or guidance from previous experience he proceeded upon his own hunch and placed the stones under water in a 700mm. vacuum for as many as twelve days, or until indications of return of colors were apparent. This procedure was in some cases repeated several times, until no further color return could be noticed.

About 90% of the charred opals slowly regained their former characteristics, their brilliance, sparkle, and color play.

(Courtesy of Zeitschrift der Deutschen Gesellschaft für Edelsteinkunde.)

If YOU'LL be moving SOON, give us your new address NOW, as far in advance as possible. We change your address ONLY UPON DIRECT NOTIFICATION FROM YOU.

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Name ____________________

Street and No. ____________________

Town & Zone __________ State __________

Effective on __________ my address will be:

Name ____________________

Street and No. ____________________

Town & Zone __________ State __________

Our Fascinating, Enigmatic Geodes

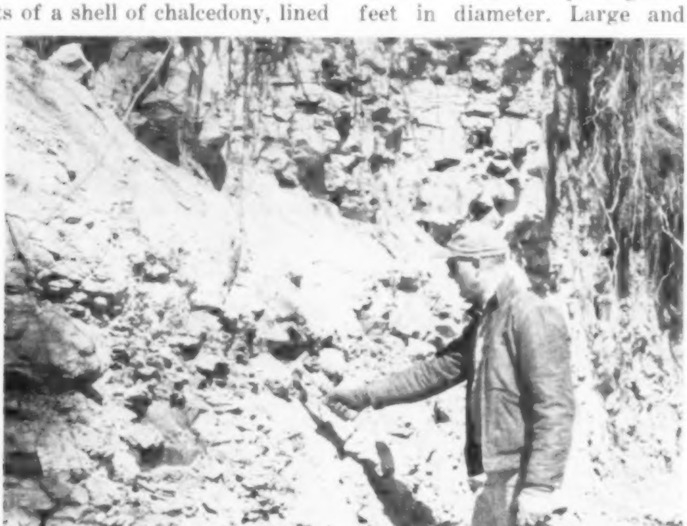
By FRANK L. FLEENER

EVERY well-appointed mineral collection should contain a few geodes. They are so fascinatingly beautiful that if they were scarcer they would command a prominent place in our display cabinets, but since they are not rare too little attention is given to them. Few specimens have elicited more questions and received less satisfactory answers than geodes.

Essentially geodes are rounded or nodular masses formed upon the inner walls of pre-exisiting cavities by the inward growth of mineral matter from solution. In the case of those most highly prized by collectors, the process of growth was halted when a lining of the cavity was formed upon which crystals, usually quartz, were grown, leaving a hollow within. However, in many cases the process of growth was prolonged until the cavity was entirely filled. These are called "duds" and are cast aside by the collectors. Thus, we see, most geodes consists of a shell of chalcedony, lined within with bright, transparent crystals of quartz, or they may contain colorless crystals of calcite, dolomite and other minerals. At times there are also found in the cavities, instead of the customary crystal array, a grayish botryoidal lining of chalcedony, often decorated with sparkling crystals of some of the sulphides of lead, zinc or iron.

Geodes are not always rounded in shape; some are irregular and nodular, or flattened. This indicates that the shape of the geode depends immediately upon the size and inner configuration of the original cavity in which it was formed; if spherical, then the geode was round; if nodular, the resulting geode would show corresponding knobs and bumps. The flattened forms received their shape from the pressure of superincumbent deposits subsequent to their formation.

In size, geodes vary from those the size of a walnut up to giants three feet in diameter. Large and small



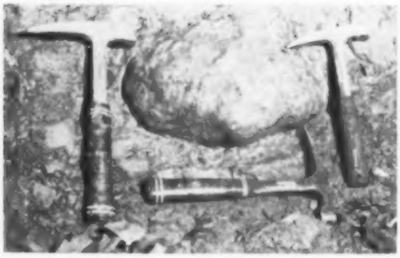
Geodes outcropping in the shale beds of the Warsaw Formation.

geodes are not, as a rule, intimately associated together in any given horizon, but there may be noticeable differences in size at different levels in the same exposure. Moreover, their size may show great variation at the same horizon in different localities. Also, geodes show a remarkable range of distribution, both laterally and vertically. In some localities, as at the O'Bleness outcrop near Kahoka, Missouri, they occur in such numbers in a given layer as to interfere with the process of normal growth, resulting in many malformed shapes. Again, they may be few and scattered, or possibly entirely absent. This is true at different levels in the same locality. Why? What is responsible for these variations? These are intriguing questions for which no answers are forthcoming.

The origin of geodes is a highly moot question, because any theory advanced to explain these fascinating forms must also explain the origin of the pre-existing cavities in which they were formed. This latter stipulation has been the stumbling block over which many an otherwise feasible theory "took a nose dive." Very naturally, there has been a plethora of theories suggested for a subject so interesting to the geological and mineralogical fraternity, but there has usually been some serious flaw in nearly all of them. One of the most plausible contributions made to the elucidation of this problem was set forth by Dr. F. M. Van Tuyl, in his report on the Mississippian Formations in Iowa. After carefully studying the occurrence of the geodes in the Warsaw formation in this area, he concluded that their origin was intimately related to the numerous calcareous concretions that he observed at some of the exposures. It occurred to him that these highly calcareous nodules, being more readily removed by underground solution, would provide the necessary cavities in which the geodes could be formed. Moreover, where present, these nodules occupy the same identical relationship to the containing strata as the geodes and possess the same shapes. Hence, it is thought that, as soon as the process of removing the concretions began, a layer of silica gel was deposited upon the wall of the opening, in time forming the chalcedony shell of the geode. What appears to be one of the most conclusive conclusions in confirmation of this supposition is the fact that many calcareous concretions have been found enclosed within a shell of chalcedony, a geode in the making. In fact, it has been demonstrated that starting with unaltered calcareous concretions, a complete series of intermediate forms may easily be assembled, which show all gradations up to the completed geode, ready to receive its final decorations.

One of the most intriguing features about the collecting of geodes is the unexpected number of adventitious minerals that are found in them. Some of these occur as scattered crystals upon the quartz lining of the shell, adding to the attractiveness of the specimen. Dr. Van Tuyl reported about twenty different species of minerals that he encountered in the geodes of the area. Some of the minerals most often met with are calcite, galenite, sphalerite, dolomite, pyrite, millerite and ankerite. Aragonite, goethite, and smithsonite are infrequently met with. Occasionally geodes from the more shaly phases of the formation will upon opening be found filled with kaolinite, in the form of a white impalpable powder, which, along with dickite, represents the residue from the disintegration of the enclosed calcareous nodule, the disintegration process having stopped before the residue was removed from the cavity. These geodes have been humorously dubbed "Cleopatra's Powder Boxes."

It has been said that there is at least one black sheep in every well-appointed family. This is a well-known biological aphorism, and, in this respect, the geode family appears to be no exception. In the vicinity of Niota, Illinois, across the Mississippi River from Fort Madison, Iowa, geodes have been found of this character, few of



Large Geode partly exposed after 2 hours digging.

Opened Geode showing "Rohm" Calcite coated with Aragonite.

which ever find their way into the collectors' cabinets. These geodes are filled with crude petroleum, black, sticky, and of a more repellent odor than any black sheep ever had. These peculiar geodes range in size from two to six inches in diameter, and the crude petroleum seems to be hermetically sealed within the cavity and under some pressure, for, when one of these geodes is broken open, the oil spurts out with some violence. It is interesting to note that doubly-terminated quartz crystals have been recovered from petroleum obtained from these geodes. One has difficulty in understanding how these quartz crystals could have been formed and deposited in the presence of thick crude oil and yet, upon close examination of the oil-filled specimens, there appears to be no physical evidence to show how the oil could have been introduced as a secondary deposition. The presence of the oil and the loose quartz crystals within the cavity of the geode poses some pertinent queries in response to which we may offer the following suggestion. The oil probably migrated up the dip of the country rock from the oil-forming region to the south until it came to the Warsaw formation and its contained geodes, where, under conditions of different rock pressures and specific gravity, the interchange was effected, and in the geodes that were still immature, growth was halted, and the residue of partially-formed quartz crystals was left floating in the oily medium. The spurting of the oil from a cracked geode may be accounted for by considering the difference in the rock pressure locked up in the geode since Mississippian times, and the atmospheric pressure outside, along with the compressibility of the oil now expanding to normal volume. These appear to be the only plausible explanations we can give to these peculiar phenomena from our understanding of present conditions.

Besides the Niota area, some oil-filled geodes have been reported as occurring south of Donnellson, Lee county, Iowa; they possibly represent the same set of conditions as those of the Niota, Illinois area.

The Keokuk, Iowa geode area has been known to exist for a very long time, possibly some 20,000 years ago when the region was populated by the Mound Building Indians. It comprises one of the largest and most productive geode areas in the United States if not in the whole world. From this area literally thousands upon thousands of geodes have been removed, sometimes by the truck load, without any apparent depletion of the supply, and this condition will prevail for many decades to come.

The Mid-West has other geode-bearing areas, such as that of Colorado, around Florissant; the Indiana-Ohio area, where the geodes are numerous but not well-formed; and others, most of which yield small and knobby geodes, in no wise comparable to those from the Keokuk area in size, number and beauty. FINIS.

All Photos: *Courtesy of Geode Industries, New London, Iowa.*

HERE REALLY IS SOMETHING DIFFERENT ! !

A beautiful bath for the beautiful birds.

Large geodes may have other uses than as decorative or conversational pieces. The one pictured here serves as a bird bath on the lawn of Professor L. D. Prewitt in Fairfield, Iowa. The quartz crystal geode itself weighs more than eighty pounds, and is mounted on a heavy metal base which at one time supported a drinking fountain.

The geode was found along the Fox River in northeastern Missouri, according to Prof. Prewitt, and is from the same formation as the world famous beds of southeastern Iowa and across the Mississippi in Illinois, elsewhere described in this issue of EARTH SCIENCE.

Several years ago Prewitt and a Parsons College student, Richard Korns by name, drove down into Missouri on a collecting trip, following the directions given in a publication of the Iowa Geological Survey, where they found a number of these large specimens lying in the bed of the river where they had rolled down into it from the eroded banks of the stream above, some also having been rolled down stream some little distance by the running waters.

The steep, slippery shale banks of the river created a real task in getting these larger specimens out, it becoming necessary to cut parallel toe and hand holds for working the geodes up the bank by holding them on the flat rests of each cut into the bank. It actually took more than an hour to get this particular specimen up to the top of the bank, where much to their dismay it was dropped right into a bed of poison ivy.

Inclusive Minerals of the Keokuk Geodes

By RICHARD B. TRIPP

(MORE light has been shed on the "Minerals of the Warsaw Formation Geodes" in a recent study made by our author and presented in a paper before the 71st Session (1959) of the Iowa Academy of Science held on the campus of Iowa Wesleyan College at Mount Pleasant, Iowa. B.H.W.)

The geodes found in the Warsaw formation of southeastern Iowa and adjacent areas present a number of interesting mineralogical inclusions, many not previously described in the literature. For the past ten years an intensive study has been made of the mineral inclusions found in geodes collected from thirty-two different exposures in the Keokuk, Iowa area. To date, the author has conclusively identified nineteen different mineral inclusions, and tentatively five others, all new.

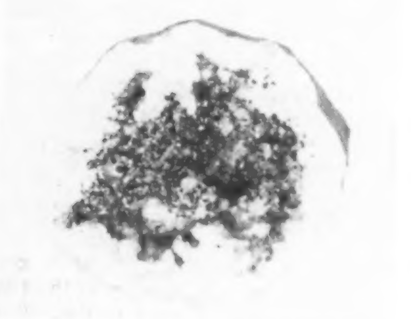
Mineral inclusions found in geodes from the Warsaw formation are numerous. The following are reported as present: quartz, chalcedony, calcite, dolmite, ankerite, barite, aragonite, smithsonite, iron pyrite, marcasite, chalcopyrite, sphalerite, sulfur, goethite, hematite, pyrolusite, kaolinite, malachite, selenite, and limonite. Tenorite and chalcocite have been tentatively identified.

Some of the mineral inclusions, such as the capillary marcasite and capillary iron pyrite, have been mistaken for millerite, blue barite for celestite, and brown rhombic calcite for fluorite. Other mineral inclusions observed in geodes have never been described, or are inadequately described. This paper will attempt to describe accurately all the known mineral inclusions found in the Warsaw formation geodes.

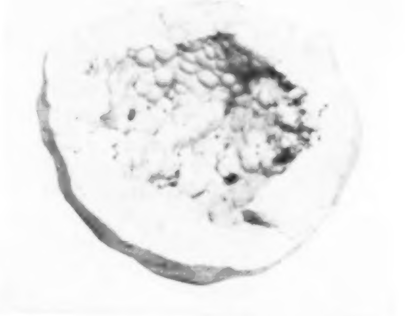
(Then follows an excellent descriptive list of 25 of the mineral species found, including the sub-varieties of quartz and chalcedony, to which we would advise those who may be sufficiently interested to refer.)*

Unidentified Mineral Inclusions: Two apparently new mineral inclusions in the Warsaw geodes have recently been observed by the author, and thus far the inclusions have not been positively identified. One of the inclusions occurs as microscopic, pale yellow, transparent fibers, believed to be the result of alteration of marcasite.

The other inclusions are black microscopic isometric crystals of octahedral forms. Work is being done on these two mineral inclusions.



Geode with Cube Fluorite Crystal Inclusions.



Typical Geode lined with Botryoidal Chalcedony.

Geode Zones: Intensive studies have shown that the geodes generally occur in four traceable zones immediately along the Mississippi River, in twenty of the thirty-two exposures examined. However, it appears impossible to trace these units westward beyond three or four miles because of bedding changes and changes in mineral suites. In the areas of traceable lithologic units, the geodes can also be traced by the mineralogical inclusions they contain. It is interesting to note that these traceable geode zones are generally interlayered with flattened, crushed, or otherwise deformed geodes, thus giving rise to speculation on origin. For a given geode zone, a general suite of minerals will be found consistently even though several of the exposures may be as much as twenty miles apart. However, the mineral suites generally differ for each geode zone, although some repetition has been observed.

*N.B. All correspondence pertaining to the distribution or procurement of copies of the Academy Proceedings should be addressed to the Secretary-Treasurer Clarence H. Lindahl, Iowa State College, Ames, Iowa.

Our author is now associated with the U.S. Geological Survey, and his present address is 11015 Central East, Albuquerque 11, New Mexico.

More About Cave Pearls

by Arthur L. Flagg

NOT all cave pearls are found in natural caves. They have been noted in man-made caves, i.e., mine workings. Since few people who are not directly concerned with the operations of a mine rarely get underground, most occurrences of cave pearls are probably never seen. Some miners are keen to detect the unusual, proof of which tendency is to be seen in the collections of minerals they have in their homes. For the most part these consist of groups of fine crystals or striking formations which stand out conspicuously. It is known that "bird's nests" have been observed but rarely brought out of the mine.

Such instances of cave pearls in mine workings as have come to the attention of the writer have not been seen in shallow prospects but rather in workings at considerable depths; some almost three thousand feet below the surface. Since visits to these deeper workings were infrequent there has been no opportunity for a careful study of any one occurrence.

However, several years ago while carrying out a development program in a relatively shallow mine (depth 350 feet) the writer had an opportunity to watch the growth of a "bird's nest" and cave pearls over a period of about ten months. Though others have made more detailed investigations of somewhat different occurrences it seems worth while to record the observations of this particular case.

The exploration work in question consisted of a drift driven along a contact between fine grained diabase and moderately coarse grained granite. There was nothing unusual in the composition of either of these two formations. The contact was marked by a nearly perpendicular wall, relatively smooth and without any irregularities. A thin clay seam or gouge about half an inch thick separated the two formations. This prospecting drift took off at right angle from a regular working drift through which ore was being mined. It was driven wholly in the diabase.

At about thirty feet from the takeoff a slow seep originating in the granite was encountered. The water came to the clay seam in the back then dripped to the floor. In a very short time carbonate material began to precipitate as a thin coating on the rocks on the floor. Gradually the interstices were filled with the white deposit forming a saucer-like basin five or six inches long by three inches in width. By the time the bottom of the basin had become completely filled in to a smooth surface the sides began to build up to the limit of the rocks which would provide support for this rim. Thickness of the side walls decreased with the height. The maximum depth of the water retained in the basin was about an inch and a half. The rate of the drip from the back was about 70 per minute except when it increased slightly for a few days after rain.

Traffic through the drift, workmen and mine cars, shook small grains of diabase into the pool. These grains were not over 2mm in diameter and somewhat angular. The force of the dripping water kept these in motion and they soon became coated with carbonate material. When the coating became so heavy that the dripping water no longer kept them in motion they became attached to the bottom or infrequently a little above on the sides of the basin.

During the time this occurrence could be observed the composition of the water must have been constant for the spheres showed only a weak tendency to banding and the color was uniform throughout. Lacking an opportunity to study similar formations from deep mines nothing can be said about what takes place in other mines. The writer has one "bird's nest" from a deeper mine supplied by an observing miner from which some deductions can be drawn.

The bowl or "nest" about four inches in diameter roughly circular by an inch in depth showed, in cross section, layers faintly tinted green (by copper salts) alternating with nearly pure white layers of nearly equal thickness. The loose "eggs" about a dozen in number were usually spherical though some were slightly flattened. All show a faint green tint on the surface. The smooth top surface of the "nest" was also tinted faint green. One egg sectioned showed an indistinct banding, green and white. There were six or eight somewhat larger "eggs" attached to the bottom.

This report of a single case does not contribute much to the previous more careful investigations of others. It is recorded for what it may be worth. Watching the development of this phenomenon was prompted by curiosity rather than a plan to make a complete study. The beginning and completion of the growth of the basin were observed. When the growth of the spherical bodies began was not noted but it was shortly after the smooth bottom of the basin had formed. It was established that a nucleus and the accumulating calcareous accretion if kept in motion by the falling water would assume a nearly spherical shape, continuing to grow until it became too heavy to be moved about by the steady dripping of the water. Then it came to rest on the bottom of the basin. Calcareous material continued to accumulate on the surface until there was finally a hemispherical protuberance seemingly integral with the smooth bottom of the basin.

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Book Reviews

ASPECTS OF THE ORIGIN OF LIFE. Edited by M. Florkin, President of the International Union of Biochemistry. Pergamon Press. 1960. 199 pp. $5.00.

Knowledge of the chemical evolution of the surface of the primitive earth is believed to hold the key to knowledge of the origin of life, a frontier our scientists have not yet penetrated. Hope of obtaining samples of the surface layers of other planets, where conditions may be similar to earth's surface before the dawn of life, is strengthened by recent advances in man's efforts to probe space.

Twenty articles selected from the Proceedings of the Symposium on the Origin of Life on the Earth, held in Moscow and sponsored by the U.S.S.R. Academy of Sciences, comprise this volume. Authors from the U.S. include Dr. Harold Urey, Linus Pauling, S. L. Miller, Melvin Calvin, and S. W. Fox.

Theories which the scientists contributed to this Symposium are necessarily nebulous in the present state of knowledge on this subject. Solar radiation, a water medium, and an abundance of elements capable of forming all possible compounds must have been present before life began. Venus, Earth, and Mars all appear to have originated with substantial amounts of water on their surfaces. Life made its first appearance on Earth when our planet was 2-3 thousand million years old. Polymerization, photosynthesis, and electrical discharges may have played a part in liberating life from mineral aggregates.

GEOGRAPHY IN THE 20TH CENTURY. 3rd Edition. Edited by Griffith Taylor. Philosophical Library, Inc. 1960. 674 pp. $10.00.

This book has an international flavor. Twenty-three geographers contributed, one author each from Czechoslovakia and Poland, the rest about equally divided between Canada, England, and the United States. Isaiah Bowman, George Tatham, and Stephen Visher are some of the U.S. contributors. The authors go far back of 1900 in giving us the background for geography's role in the present century. Evolution of the science is traced from Aristotle, the Greek, through the writings of German, French, English, and other European geographers.

In a definition credited to Isaiah Bowman "Geography tells what is where, why, and what of it." Geography has thus advanced far beyond a series of recitations on the description of the earth. Its relation to man and his progress has been the subject of philosophical debate for some years. Adherents to the early traditional school hold that environmentalism or determinism is sound, i.e., natural environment determines how man shall develop. The more liberal theory of possibilism has attracted a following in the past century, however. This latter theory holds that nature does not drive man along any one particular road but offers him a number of opportunities from which he may choose. Each will have its price. What society is willing to pay for its development in any one direction (say, building a metropolis at the South Pole) will determine the choice.

Professor Taylor holds that 5 major groups or races of man exist. They are Alpine, Mediterranean, Australoid, Negro, and Negrito. All dispersed from a common heartland in Central Asia. This author has an interesting theory concerning dispersion. In relation to a center where evolution is taking place, the various differentiated classes will be found to arrange themselves in zones, with the most primitive at the margins and the most advanced at the center.

As the importance of geography is recognized, the boundaries of our political subdivisions may be changed. States may be replaced by river basins as political entities, or the great metropolitan areas with their environs may constitute political units. On the international scene the nations of Western Europe may finally unite to form a third great geographical empire as a foil between those of the U.S.S.R. and the United States. These speculations are far from fanciful and certainly highly interesting.

Applications of geography are shown to be legion. Our only criticism of this book would be because of its length and some tendency to repetition. The chapters on meteorology, cartography, geography and aviation, and the geographical interpretation of air photography are written with an awareness of the challenges of the space age. A valuable glossary of geographical terms is appended.

HYDRODYNAMICS OF OCEANS AND ATMOSPHERES. Carl Eckart, University of California, Scripps Institution of Oceanography. Pergamon Press. 1960. 290 pp. $9.00.

This book provides a mathematical basis for the behavior of stratified compressible fluids, i.e., the atmosphere and the oceans, without consideration of geophysical turbulences. It is intended to bridge a gap between the fundamental mathematical physicist, and the meteorologist and oceanographer.

The thermal stratification of fresh-water lakes as contrasted to stratification of the oceans is described. The thermal state of the former is much less stable than that of the oceans, and small fresh-water bodies tend to be more stable in thermal stratification than large bodies. The complex phenomenon called "overturn" is described. Reference is made to studies of Lake Michigan.

THIS SCULPTURED EARTH. John A. Shimer, Asst. Professor, Brooklyn College. Columbia University Press. 1959. 255 pp. $7.50.

The sub-title of this book is "The Landscape of America." The illustrations, sketches, and maps are almost entirely of noted physiographical features of the North American continent. Dr. Shimer has been an observant visitor to our national parks and monuments. He writes from a background of training in geology but of familiar objects and in a language the layman can understand.

There are some 75 beautiful illustrations in black and white. Subjects include many of the great mountains of the west such as Going-to-the-Sun, Beartooth, the Tetons; basalt columns of Yellowstone; Crater Lake; and several close-up photographs of the old lava flows at Craters of the Moon. By means of aerial photographs we can look down on the drowned coasts of Massachusetts and Maine, note the shape of Yosemite's glacial valley, and the meanders of old rivers.

This is a book to read at home and to take with you on vacation trips. You will understand and appreciate the beauty of your country more with its help. A glossary of geologic terms, made especially valuable by accompanying imaginative sketches, is an unusual feature of the book.

GEOLOGY. Richard M. Pearl, Assoc. Professor of Geology, Colorado College. Barnes & Noble, Inc. 1960. 260 pp. Paperbound $1.75.

This book is No. 13 in the College Outline Series. Professor Pearl refers to it as a "comprehensive survey and summary" which is designed to help the beginning student to organize his study and to be useful to the advanced student in reviewing.

An interesting feature of the book is the tabulated bibliography of standard textbooks. Here the author relates his material, by page spans, to chapters dealing with the same subjects in 21 standard geology textbooks.

The text comprises two parts: I. Physical Geology, dealing with the composition of the earth and the space around it, and its relation to the various other planets. II. Historical Geology, dealing with the origin of the earth, evolution of life, etc.

Professor Pearl has the gift of clarity in his writing. Adults interested in geology as an avocation would do well to adopt this little Outline as a study guide.

ULTRAVIOLET GUIDE TO MINERALS. Sterling Gleason. D. Van Nostrand Co., Inc. 1960. 244 pp. $6.95.

The author, a long-time correspondent of Popular Science Monthly, prepared himself for a journalistic career by topping his B.A. degree from the University of Southern California with an M.A. from the same institution. As a member of the Los Angeles Mineralogical Society, his knowledge of fluorescence in minerals is more than superficial. Credit for suggesting the writing of a practical guidebook that would focus the bits of information about fluorescence gleaned from prospectors and miners into something like a comprehensive whole is given to Mr. Thomas S. Warren, President of Ultra-Violet Products, Inc. and of Black Light Corporation of America.

Mr. Gleason whets our interest by stories of fabulous mineral finds by the use of a fluorescent lamp, tells us what we should know about the workings of the lamp, and gives us tips on ultraviolet field techniques. The meat of the book is in seven field identification charts, one for each color which the more common minerals assume under ultraviolet light. Under red, for example, the author lists corundum, spinel, hackmanite, nepheline, rhodonite, wollastonite, calcite, aragonite, dolomite, halite, talc, and several other minerals. For each, besides a description of its behavior under the fluorescent lamp, the chart shows chemical composition, daylight color, physical characteristics, hardness, luster, streak, specific gravity, and distinguishing tests. For the prospector, also, is given an outline of simple chemical tests inducing fluorescence.

A table has also been included for the collector of specimens showing the behavior of the more rare minerals under both short-wave and long-wave light.

A text on ultraviolet without colored illustrations would be unimpressive. Mr. Gleason has included some very striking color photographs in his book. He ends with a resume of recently advanced theories on the causes of luminescence.

Midwest Club News

Mrs. Bernice Rexin, Club Editor
3934 N. Sherman Blvd.
Milwaukee 16, Wisconsin

LAKE ERIE GEM AND GEOLOGICAL SOCIETY recently celebrated the completion of its first year. It has grown from 18 to 42 members and during 1960 its members were seen in Nova Scotia, Washington State, Canada, Mexico and at both Midwest Rockramas.

KALAMAZOO GEOLOGICAL AND MINERAL SOCIETY visited the Mazon Creek area in Illinois during October to collect plant fossils from the Pennsylvanian period. All arrangements for the trip were made by Vern Montgomery, Central Regional Vice-president of the Midwest Federation. William Allaway, Associate Editor of *Earth Science*, assisted him as a field trip guide. Both Bill and Vern are members of the Earth Science Club of Northern Illinois. After a day of successful collecting, the visiting club attended a meeting of ESCONI to hear an interesting talk on "Mastodons in the Chicago area," by Professor Clarence R. Smith of Aurora College.

WISCONSIN GEOLOGICAL SOCIETY held its annual Christmas banquet on December 3. Highlight of the evening was a colored-slide program entitled "Rockhound's Paradise," by Rev. Luke McMillian. The slides included beautiful scenes of the Garden of the Gods, Grand Canyon, and Carlsbad Cavern.

ILLINOIS VALLEY ROCKHOUNDS SOCIETY on Oct. 26-29 held a million-dollar exhibition of gemstones and mineral specimens from all over the world. In addition to the real diamonds shown there were replicas of most of the famous ones, including the Hope, Mogul, Star of Arkansas, Star of the South and Cullinan diamonds. Among the working exhibits was a demonstration of diamond cutting and polishing.

FIRELANDS GEOLOGICAL SOCIETY on Oct. 3 met with the Good Earth Mineral Society for a joint field trip to Strongville, Ohio to collect selenite crystals from a road cut, and on Nov. 13 the two societies again joined forces for a field trip. This time they visited a quarry that is seldom open to collectors and obtained blastoids and other fossils as well as calcite crystals.

EVANSVILLE LAPIDARY SOCIETY made a field trip during October to Brown County to pan for gold and to collect geodes. Only a few flecks of gold showed up in the prospectors' pans, but the geodes were plentiful.

GRAND RAPIDS MINERAL SOCIETY was given a demonstration and talk on the "V-lock Method," by Doris Kemp of the Chicago Lapidary Society, at its October meeting. The piece of jewelry made by Mrs. Kemp during her demonstration was given as a door prize at the club's November meeting. This solderless method of making jewelry has unlimited design possibilities and is therefore more stimulating to the creative artist than the conventional method involving the use of solder.

CENTRAL IOWA MINERAL SOCIETY'S guest speaker at its November meeting was Dr. Arthur Montgomery of LaFayette College, Easton, Penna., who made a special trip to Des Moines for the occasion. His interesting talk on "The Atomic Structure of Minerals" was accompanied by descriptive slides. Also present at the meeting were guests from the Des Moines Lapidary Society, and the mineral clubs in Ames, Dallas Center, and Marshalltown, Iowa.

ISHPEMING ROCK AND MINERAL CLUB has a large display of minerals at the Ski Museum and has voted to use part of its convention profits to buy more material for the cases.

EARTH SCIENCE CLUB OF NORTHERN ILLINOIS' December meeting featured a talk by David Wenner, a Director of the Illinois State Geological Survey, on "Recent Developments in Archeology." During the past ten years Mr. Wenner has been concentrating on the Indian cultures of the Chicago region and has been an active participant in field excavations in the area.

MICHIGAN MINERALOGICAL SOCIETY at its October meeting was presented a film and slide program by Dr. Willard Parsons on the Kilauea eruptions which occurred last January and February. They were preceded by swelling of the volcano and earthquakes. Lava flowing out of the volcano during the eruptions was found to be about 1100 degrees Centigrade. Hastily constructed earth dikes modified its flow somewhat, but it still caused millions of dollars worth of damage. A crust forms quickly on the surface of a lava flow, but it will not solidify completely for about 100 years.

CENTRAL MICHIGAN LAPIDARY AND MINERAL SOCIETY on Nov. 17 heard Leon North give a talk on "America's First Rockhounds." Mr. North described the materials used by the Indians and what they did with it. A large number of Indian artifacts were displayed by both members and specially invited guests.

TRI-STATE GEM AND MINERAL SOCIETY OF DUBUQUE'S guest speaker on Oct. 30 was Dr. B. H. Beane of Le Grand, Iowa who chose as his topic "Treasures from an Ancient Sea." Dr. Beane is a leading authority on life in Iowa during the Mid-Mississippian period of the Paleozoic era, 200-300 million years ago when Iowa was under a shallow inland ocean and the climate was balmy. Dr. Beane has been collecting fossils, especially starfish and crinoids, for 65 of his 89 years. He has had the honor of naming many of the types of crinoids found at Le Grand, Iowa. Le Grand was favored in the preservation of fossils by a sudden deposit of silt which held the crinoids in their natural state while elsewhere storms or deterioration left only fragments. Dr. Beane has been known to spend as much as three months on a single slab of limestone bearing fossil crinoids, painstakingly working out the full outline of the fossils with a fine needle.

SHAWNEE-MISSION GEM AND MINERAL SOCIETY recently made its second trip to Jet, Oklahoma to collect selentite crystals. It is in this area that member Fred Ferrar dug out a fine cluster of selenite crystals which measured 25 inches in length and 16 inches across its greatest width. The society insured a return welcome by not leaving a scrap of paper or any sort of debris on the site and by putting every grain of sand back in the hole from which it was dug.

MARQUETTE GEOLOGIST ASSOCIATION on Dec. 3 enjoyed an illustrated talk on "Fossils of the Pennsylvanian Era," by Harry Witmer, President of the Earth Science Club of Northern Illinois. About 250,000,000 years ago a jungle of tropical plant life grew in Northern Illinois and fossils from this era are now found in the Wilmington area.

MICHIGAN LAPIDARY SOCIETY at its November meeting heard Frank Passal of the Metal Thermit Corp. talk on "Plating", with particular emphasis on silver and rhodium plating of small objects such as jewelry. Mr. Passal has devised a small plating plant for use in a home workshop.

CHICAGO LAPIDARY CLUB on Oct. 13 heard John Willhammer, author of "Rock Polishing for Everyone," discuss various techniques for cutting and polishing stones. Mr. Wilhammer recommends using cotton velvet cloth as the backing for the polishing agent, tin oxide. His lecture was illustrated with chalk-board drawings and sparked with humor.

DES PLAINES VALLEY GEOLOGICAL SOCIETY at its October meeting was presented an illustrated lecture on "How to Photograph Rocks and Minerals," by Mr. and Mrs. Loren Root of the Fort Dearborn-Chicago Camera Club. On display were the actual specimens pictured on the slides. They discussed the basic problems of mineral photography, including choice of equipment, film, lighting and technique.

On Nov. 19 the Society heard an illustrated lecture on "Silver-smithing," by Mrs. Elva Maas who teaches this art. Beautiful examples of Mrs. Maas' handicraft were exhibited at the meeting.

MESABI ROCK AND MINERAL CLUB'S mineral collection was started six months ago by the donations and loans of club members and collectors from all over the United States. It has now grown to over fifty specimens and the society is looking for a place to display it.

ELKHART MINERAL SOCIETY held a Rock Bazaar to raise funds for a workshop at its October meeting. Dealer members put on a rock show and donated part of the profits from their booths to the club. A treasure island in the middle of the hall, where specimens donated by members were sold to the public, yielded a nice profit. An unusual feature was a parcel post auction of unopened packages (containing rocks) mailed to the club by members during their summer vacation.

CINCINNATI MINERAL SOCIETY recently heard Dr. Thomas B. Cameron, Professor of Chemistry at the University of Cincinnati, speak on "Garnets." He did a splendid job of covering both the lime (grossularite, uvarovite, andradite) and aluminum (pyrope, almandite, spessartite) types of garnets.

During October the club made a week end field trip to Northern Ohio. The collecting was not too spectacular, but one member found a fine specimen of ruby sphalerite associated with 1½ inch cubes of fluorite.

KANSAS CITY LAPIDARY CLUB held its first meeting on Nov. 19 with 43 lapidaries present. The election of officers was held on Dec. 2. For information about this new club write: Jim Harris, 4504 No. Charlotte, Kansas City 16, Missouri.

CHICAGO ROCKS AND MINERALS SOCIETY is featuring a course on mineral identification which is being taught by Dr. Haddock of Wheaton College. The club now has a circulating library of several hundred books and has set aside a budget to buy additional books of interest to the rock and mineral hobby.

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IMPORTED GEM MATERIALS. Buy from your resident, reputable, and well established dealer: Selected tumbling cabochon, and choice faceting materials in the rough. Our specialty is still Australian Fire Opals. Also everything in cut stones such as Jade, Sapphires, Rubies, Emeralds; also Synthetics, etc. Price list available, wholesale and retail. FRANCIS HOOVER, 11526 Burbank Blvd., North Hollywood, Calif.

50c BRINGS YOU our beautiful catalog, 3 Sapphires and piece of Uranium. $1.00 for the above, plus "3 Arizona Rubies" and piece of sparkling Galena. WHITE MOUNTAIN MINERALS, Campton, New Hampshire.

BARITE ROSES. Choice $1.00. Amazing Sand-Calcite crystals 25c up. Minimum order 50c plus postage. Choice Thumbnail to cabinet sized clusters from $1.00. Orders over $1.00 postpaid. Complete line of Rockhound & Lapidary supplies including rough and slabs. Dearlers' inquiries invited. SOUTH BEND ROCK SHOP, 915 S. 32nd St., South Bend, Indiana.

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INDIA IMPORTER has crystal and gem specimens for rock collectors; uncut; this material not perfect enough for gems but will greatly enhance your collection; India star rubies from 75c to $1.25, moonstones 65c to $1. E. D. SKINNER, P.O. Box 4252, Station K, Milwaukee 10, Wis.

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QUARTZ CRYSTAL BAROQUES, heat treated, colored blue, green, rose, golden, and clear. About 100 to a pound, assorted, $4.50 per pound. Assorted Baroques: agates, tigereye, woods, about 200 per pound, $4.50 per pound. Cullet Baroques, assorted colors, about 150 per pound, $3.75 per pound. Slabs: South American agate, novaculite, jaspers, woods, etc., 20 sq. in., $3.50. All above postpaid. CHAS. E. EAGLE, 410 South 5th Street, Watseka, Illinois.

WYOMING JADE, generous slab, $1.00. Choice: black, olive green, and phantom. Variety of tumbling material, 5 lbs., $1.00. Good cutting material: oolite, wood, agate, jasper, algae, turritella, 25c/lb. Medicine Bow agate, stalagtite formation with dendrites, also fluorescent, $1.00 per lb. Fossil fish, $1.50 to $5.00. Add postage. WITKA'S Hiway 30, West-end, Rock Springs, Wyoming.

DEALERS: Write for wholesale price lists on our fabulous line of nontarnishing aluminum chains and findings. If you include $1.00, samples will also be sent. Please include your tax number with letter. R. B. BERRY & CO., 5040 Corby St., Omaha 4, Nebr.

10 RING SIZE PREFORMS, Plume moss, etc. with our lists; $1.25, including tax and postage. Rough slabs, preforms, cut stones, and mountings, all at sensible prices. HUNTER & SONS, 465 — 21st Street, Springfield, Ore.

BAROQUE GEMSTONE KITS. A must for every rock shelf. 12 polished baroques mounted in a fancy box, printed with identity and origin of the stones, $1.00 postpaid. Dealers' inquiries solicited. STYLE CRAFT, 1262 Eastern Ave., Morgantown, W. Va.

IMITATION 18 x 13mm CABOCHONS. Goldstone-Fire Opal-Lapis Lazuli-Hematite-Chrysoprase, dozen 60c. Acrylic Agacites: Amethyst-Emerald-Sapphire-Topaz-Cornelian-Garnet-Rose, dozen 40c. Post-paid. R. MYLES HERBER, Box 176, New York 8, N.Y.

Minerals, Petrified Wood

WHOLESALE GEM MATERIAL. Save freight. Your choice—10 kinds. Palmwood, Opalite, Jasp-agate, Budseye, Golden Onyx, Crawfordite, Jasper, Chapenite, Verde antique, Travertine (green). $16.50 per 100 lb. bag. Freight paid. Sample $5.00 postpaid. MORTON MINERALS & MINING, 21423 Hwy 66, RFD 1, Barstow, California. Dept. E.

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WANTED TO BUY: Minerals and Ores. Tourist or pound type for beginners' study sets. Will refund postage for samples and lists. HENRY KLIMEK, 23135 Edward Street, Dearborn, Mich.

THUNDER EGGS, Agatized Wood, cab size or mixed Tumbling Agates 40¢ lb. in 100 lb. lots, freight paid. Two lb. piece petrified wood $2.00 postpaid. WALT'S ROCKS, Nyssa, Ore.

MEXICAN AGATE: Slabbing Package Special #220. 2 lbs. Casa Grande size 1½" to 2", 2 lbs. Persalles 1½" to 2", 2 lbs. Moctezuma 1½ to 2", 4 lbs. Sagenite type Lace good size, 2 lbs. Coyamite ¾ to 1¼". Postpaid anywhere $17.00. B. & H. ROCK SHOP, Granbury, Texas.

FOR OUTSTANDING CABS try our slabs of Amethystine, Aventurine, Crazy Lazy, Dendritic, Flame and Green Moss Agate, Flowering Obsidian, Honey and Silver Onyx, Prase, Oolite, Moss Opal, Gold Tiger Eye, and Wonder Stone, 4 square inches $1.00. Algae, Arizona Wood, India Jasper. Brown and Black Obsidian, Rhodonite, and Turritella Agate, 5 square inches $1.00. Mixed Baroques $5.00 lb. Oregon Thunder Eggs, small 50¢ each, large 75¢ each. We handle Rough Material, Lapidary Equipment, and Findings. RUBEY'S ROCKS, 9624—49th Ave., Oak Lawn, Illinois.

FINE MINERAL SPECIMENS: Jarosite (Massive), New Mexico, 4x4" $3.00, 3x3" $2.00. Heulandite, Calcite, New Jersey, 2½x5" $2.50 to $3.50. Pollucite, Sweden, 1" 50¢, ¾" 40¢, 2½x3x2" $8.50. Pollucite, Africa 2½x4" $7.50. Adamite, Fl. Bright Green, Mexico, 1½x2" $2.50, 3x4" $7.50, 2x3" $3.50. Aragonites, choice, attractive, Chihuahua, Mexico, $1.50, $2.00, $2.25, $3 00. Postage please. PETER'S ROCKS & MINERALS, 1316 East Colfax Ave., Denver 18, Colorado.

SOUTH TEXAS AGATE from the Rio Grande. Variegated colors and patterns. Carefully selected for slabbing and cabochons. 7½ lbs., $5.00 postpaid; 100 lbs., $35.00 FOB. THE AGATE SHOP, 704 W. Kimball, Raymondville, Texas.

MINNESOTA ALGAE, Jasper or Petoskey Stone, $1.00/lb. Over 10 lbs., postpaid. Tumbled Wyoming mixture; Agate, Jasper, Wood, $4.00/lb., postpaid. Variety of rough, slabs, tumbled, grits, some findings. Lapidary Equipment: "Rock," "Frantom." Open after 4:00 P.M. HAZETT STAMP SHOP, 620 North Grant, Bay City, Michigan.

CANADA OFFERS YOU quality mineral specimens, 1" x 1" pieces. Genuine Native Silver in calcite, $1.25; Skutterudite, $0.25; Erythrite, $0.50; Annabergite, $0.75; Niccolite, $0.85; minimum order $2.00, plus postage. All above minerals, slightly smaller, in hinged plastic box, labelled, $3.15. Money order please. NORTHERN MINERALS, P.O. Box 834, New Liskeard, Ontario, Can.

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ROCK COLLECTORS, Mineral Buyers, Prospectors: 25 selected specimens including gemstones. Irons, Coppers, Uranium, Mica, Gold and Silver Bearing Ore. $3.00 for a set of 25. Also individual specimens of beryl crystals $1.50 each. Staurolite Crosses at $1.00 each. Superior Agate at $2.50 per lb. Nickel specimens $1.50 each. Also A MUST FOR EVERY PROSPECTOR—a Booklet on that Hottest Mineral of the 20th century BERYLLIUM. $3.00 per Booklet. ROBERT N. KINZER, Route 2, Hillman, Minnesota.

MEXICAN AGATE: Tumbling Package Special #110. 2 lbs. Amethyst broken crystals, 2 lbs. Psilomelane, 2 lbs. Rexite, 2 lbs. purple broken Agates, 4 lbs. colorful Lace, 2 lbs. Red Moss. Postpaid $12.00. B. & H. ROCK SHOP, Granbury, Texas.

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TRADERS! Young rockhounding club needs to stock their rock pile. We have fossils, Ohio gem flint, minerals, and crystals. What do you have? Correspond with HARRY A. CARLSON, 430 E. Clearview Ave., Worthington, Ohio.

FOR SALE: Established, complete Rock Shop on highway 60-70 & 95. This includes a 4-room house with land; 78 foot frontage on highway by 320 feet deep. My reason for selling is my health. For full information, write to H. P. WILLIAMS, P.O. Box 132, Quartzsite, Arizona.

FIND VALUABLE MINERALS while hunting, fishing, prospecting, or gem hunting. Here are a few of the 300 or more you may be overlooking: uranium, vanadium, columbium, tantalum, nickel, cobalt, tungsten, selenium, germanium, chromium, bismuth, tin, mercury, gold, platinum, beryllium, emeralds, etc. Some worth $1 to $3 a pound, others, $25 to $200 per ounce. An emerald the size of your thumb may be worth $500 to $5000 or more! Learn how to find, identify, and cash in on them; new simple system. Send for free copy, "Overlooked Fortunes in Minerals". It may lead to knowledge which may make you rich. DUKE'S RESEARCH LABORATORY, Box 666-C, Truth or Consequences, New Mexico.

CLUB PROGRAM CHAIRMEN—Booking itinerary for 1961 "Traveling Rock Box." Exchange material from your favorite collecting areas for cutting material from ours. Shipping charges "Collect" each party. For details write LAKESIDE GEM & MINERAL CLUB, INC., P. O. Box 1185, Kennewick, Washington.

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MUSEUM DIRECTORY, "Mineral, Fossil, Rock Exhibits and where to see them." Lists information on nearly 200 public museums in U.S. and Canada with geological exhibits. Order from AMERICAN GEOLOGICAL INSTITUTE, 2101 Constitution Ave., Washington 25, D.C. $0.50.

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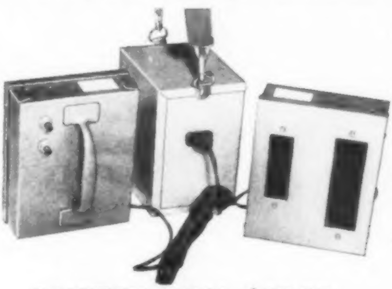

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See Page 8 For Further Information